HISTORY OF ADCOM

1 JANUARY 1977-31 DECEMBER 1978

Approved By:

JAMES E. HILL, General, USAF
Commander in Chief

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FOREWORD

This history is exceptional in that it deals with two calendar years, 1977 and 1978, instead of one. Its major headings conform to the command's principal missions of atmospheric air defense, missile warning and space surveillance. The manpower reduction in the History Office in October 1977, the retirement of the ADCOM historian, Mr. Harold Buss, in February 1978, the four-month lag-time in the arrival of the new command historian, and the need to indoctrinate him in aerospace defense history placed an unusual burden on the history office staff. They responded above and beyond duty's call.

Should the anticipated reorganization of ADCOM proceed as planned, this will be the penultimate command history. The closeout history will cover the period January 1979 to the disestablishment of ADCOM as a major command, the exact date of which at this writing is unknown.

This history was written by Mr. Robert M. Kipp, Mr. John W. Dennison, and Ms. Mildred W. Wiley. All editorial tasks were performed by Mrs. Viola S. Daniels. All chapters have been coordinated with appropriate staff agencies of this headquarters. Nevertheless, Office of History remains responsible for any remaining errors of fact or interpretation.

Robert M. Kipp
ROBERT M. KIPP
Command Historian

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NORAD

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LIST OF ILLUSTRATIONS

CHRONOLOGY

b1 b1

14-17 Feb 77 VIGILANT OVERVIEW/SNOW TIME 77-2 exercise conducted.

5 Mar 77 b1

14 Mar 77 Baker-Nunn Camera moved from Sand Island to Pulmosan, South Korea. Camera became IOC on 15 May 77 and FOC on 23 Jun 77.

14 Apr 77 b1

29 Apr 77 b1

2-5 May 77 VIGILANT OVERVIEW/SNOW TIME 77-3 exercise conducted.

Jun 77 ADCOM formally accepted the completed raising of DYE-2 DEW Line site contracted by Danish Arctic Contractors for $1,911,700.00.

1 June 77 Operating Location AD, 630th Radar Sq (Z-241), was inactivated at Lackland AFB, TX.

5 Jun 77 Second Block 5D DMSP satellite, F-2, launched.

11 Jun 77 b1

23 Jun 77 b1

30 Jun 77 The 656th Radar Sq (Z-50) was inactivated at Saratoga Springs AFS, NY.

30 Jun 77 The 676th Radar Sq (Z-19) was inactivated at Antigo AFS, WI.

13 Jul 77 ESD turned over AN/FPS-108 (Cobra Dane) at Shemya AFS, Alaska, to ADCOM. AN/FPS-17 and AN/FPS-80 were inactivated on 1 August 1977.

1-4 Aug 77 VIGILANT OVERVIEW/SNOW TIME 77-4 exercise conducted.

5 Sep 77 b1

6 Sep 77 b1

25 Sep 77 Rumor that the Air Force was studying the possible disestablishment of ADCOM first appeared in Colorado Springs newspapers.

26 Sep 77 b1

early Oct 77 ADCOM received for comment the first draft of the Air Staff study, "Proposal For: A Reorganization of USAF Air Defense and Surveillance/Warning Resources."

1 Oct 77 U.S. Army transferred PARCS Concrete Missile Early Warning Station over to ADCOM.

1 Apr 78 — The 644th Radar Sq (Z-210) was inactivated at Homestead AFB, FL.

19 Apr 78

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19 Apr-20 May 78 — MAPLE FLAG D-1, joint exercise of Canadian, USAF, and USMC forces, conducted at CFB Cold Lake, Alberta, Canada.

30 Apr 78 — Third Block 5D DMSP satellite, F-3, launched.

3 May 78

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15 May 78 — AFSC awarded $33.4 million contract to Thompson-Ramo-Woolridge (TRW) Incorporated for Ground-based Electro-Optical Deep Surveillance System (GEODSS).

15-18 May 78 — VIGILANT OVERVIEW/SNOW TIME 78-3 exercise conducted.

17 May 78 — The 57th FIS, Keflavik IAP, Iceland, completed conversion from F-4C to F-4E aircraft.

levels be measured before and after the radar was put into operation, but emphasized that radiation levels were safe enough to allow work to continue.[73]

6th Missile Warning Squadron

. On 1 October 1978, Operating Location (OL) OLAK of the 21st Air Defense Squadron (SAGE) was inactivated and the 6th Missile ~~Working~~ Warning Squadron was activated at Otis AFB, MA.[74] The 6th Missile Warning Squadron (MWS) was made responsible for operating, maintaining, and managing the PAVE PAWS radar at Otis. It was assigned to the 21st Air Division and had 204 personnel authorized.[75]

At Beale, OLAQ, 26th Air Defense Squadron (SAGE) would not be inactivated and the 7th Missile Warning Squadron activated until October 1979.[76]

Defense Support Program

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Their operational mission was to provide information for tactical warning of missile launches and data on nuclear detonations.

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This information is reported to the National Military Command Center (NMCC), Alternate National Military Command Center (ANMCC), the SAC Command Post, and the NORAD/ADCOM Combat Operations Center (COC). Information to other users was transmitted by teletype.[77]

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Seven DSP satellites had been launched.

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Two satellites were being held on the ground as spares in the event that one of the current airborne satellites had a failure and two satellites were in production.[84]

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Flight 3 Operational Test

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Lagopedo Experiment

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Sensor Evolutionary Development Program

The Sensor Evolutionary Development (SED) program was the next major modification improvement program for the production satellites. SED would include the TSEC/CI-1 anti-jam command system, a modified focal plane

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an Above-the-Horizon (ATH) viewing capability, an improved electronic package, an improved infrared sensor, and an option to be compatible with the Space Shuttle.

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* Lagopedo was a bird of the grouse kind or genius consisting of ptarmigans and red grouse. The word comes from the Greek meaning: Lagos-hare+ podos-foot.

Satellites 5, 6 and 14 would have the SED improvements. The "on the shelf" satellites, would be modified once the others were completed.[95] b1

Currently, SED would cost $250 million for one new version (Flight 14) and two retrofitted sensors (Flights 5 and 6). Upgrading the ground station computers and software was currently estimated to cost $53 million.[97]

Possible Nuclear Underground Test Procedures

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Mosaic Sensor Program

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Ground Environment

The DSP ground environment consisted of the Continental United States (CONUS) Ground Station (CGS) b1

the Ground Communications Network (GCN) and user displays. The station facilities at the CGS and Overseas Ground Station (OGS) were self-sustaining as far as power, water, and similar support activities were concerned.

The OGS, b1

monitored ICBM, IRBM, SLBM, and MRBM launches from the eastern hemisphere to give adequate warning time in the event missiles were launched toward the United States or North Atlantic Treaty Organization (NATO) countries.

The CGS, b1

Sea launch ballistic missiles launched toward the United States from submarines off the coast of the U.S. required detection and monitoring

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The ground stations provided all processing that occurred between satellite trans- mission of data and the relaying of reports to the users. A ground station was comprised of a Satellite Readout Station (SRS), a Data Reduction Center (DRC), and a Tactical Operations Room (TOR). The SRS received the satellite transmissions, processed them, then routed them to the DRC. The DRC reduced the incoming data, pre- pared it for the displays, and transmitted reports through the Ground Communications Network (GCN to the users.

The GCN provided two-way voice and data communications among the OGS, CGS, and the users. The central hub of the network was the Data Distribu- tion Center (DDC), located at the CGS. The GCN equip- ment located at the OGS provided communications between the OGS and the DDC, and intrastation communications. Part of this equipment was a special satellite ground station that made use of a communications satellite. The CGS portion of the GCN transmitted processed data to the users and provided both interstation and intra- station voice and interstation teletype communications for the CGS. Interstation communication consisted of secure digital data transmission between the ground station and the operating command. Intrastation communication provided CGS administrative telephone service to the technical building support areas and network conference intercommunications and paging service to the technical area.[100]

Triplex Data Reduction Center

The Triplex Data Reduction Center installation was completed at the CGS on 14 April 1977. The term, Triplex, was used to describe the building expansion

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Satellite Tracking Set Training Equipment

The Satellite Tracking Set Training Equipment (STSTE) provided a hands-on maintenance training capability for the radio frequency equipment of the DSP.

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Simplified Processing Station

On 10 June 1977, ADCOM published Required Operational Capability (ROC) 3-77 for a Simplified Processing Station (SPS). The purpose of the SPS was to increase survivability of the satellite ground environment through proliferation of ground stations.[103] Although there appeared to be an urgent need for ground environment survivability, the SPS program had met a series of delays. Funding was a major problem. Prototype development was estimated to cost $35 million. The FY 78 POM deleted all production SPS funds. Then military site preparation construction funds were being held up due to a change in location for the prototype.[104] The Requirements Review Group (RRG) reviewed the ROC on 19 December 1977 and validated the requirement for DSP data survivability but not the number of sites. The RRG validated the pre-attack data survivability requirement but not the trans-attack and post-attack periods. RRG gave the high cost of the investigate other solutions. In April, ADCOM returned program as the reason trans and post-attack were not validated. The Air Staff directed AFSC and ADCOM to investigate other solutions. In April, ADCOM returned with a briefing and recommended Mobile Ground Terminals to provide near-term, pre-attack survivability. At the same briefing, SAMSO presented the far-term, wartime survivable

system.

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Another concept, referred to as the Mobile Ground Terminal, was also introduced.[105]

The Mobile Ground Terminal (MGT) concept had developed over the previous six months as a trans-attack and post-attack data survivability system. MGT, referred to as "Midget," consisted of deploying Mobile Ground Terminals and associated communications terminals in truck mounted vans that could change locations frequently and could be set up and torn down

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SPS hardware and software technology would be used for the MGTs. ADCOM was preparing a System Operational Concept (SOC) which was due in February 1979 to the Air Staff.[106]

Criteria for Site Selection of the SPS

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Ground Data System Updating Change

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Defense Support Program High Speed Data Survivability

The DSP High Speed Data (HSD) program was to provide greater survivability for communication data.

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Australian Telephone Company Strike

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Perimeter Acquisition Radar Attack Characterization Sytem

The Perimeter Acquisition Radar Attack Characterization System (PARCS) was a phased array AN/FPQ-16 radar initially built as part of the Army's SAGEGUARD system. When the SAFEGUARD Ballistic Missile Defense System was inactivated, PARCS, whose primary mission was long range detection and attack characterization support, was offered to the Air Force as part of ADCOM's surveillance and warning system.[126] From the onset, ADCOM held certain reservations about PARCS because of its high operating costs and redundant coverage. PARCS had some unique capabilities but it would have had greater utility for surveillance and warning had it been placed on the northern fringe of the North American continent instead of hundreds of miles further south in North Dakota. ADCOM considered

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PARCS Software

Software had been developed that would give PARCS the capability for early warning confirmation and attack characterization. The software package was to be installed in three phases. Phase I was modification of SAFEGUARD software so that it would be compatible with PARCS, and it was completed in December 1976. Phase II was the User Integration Test (UIT) of the software. Two UITs were conducted, one on 4 January 1977 and the other on 24 January 1977. Phase III was full PARCS reporting to the NCMC, which began 1 February 1977.[139]

To provide PARCS with full Spacetrack/ Space Object Identification support capability as well as enhancing SLBM coverage, a software package, referred to as Tactical Load Module (TLM) 4.3, was developed.[140] TLM 4.3 was installed in October and November 1977,[141] with ADCOM taking final acceptance of the software on 29 December 1977.[142]

Enhanced PARCS

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Military Uses of Space: 1946-1991

Published by:
Chadwyck-Healey Inc., 1101 King Street, Alexandria, Virginia 22314

Military Uses of Space: 1946-1991 provides a detailed record of the strategic importance of the U.S. military space program from the conceptualization of the uses of space to the present realization of advanced capabilities. Materials were identified, obtained, assembled, and indexed by the National Security Archive, a non-profit, Washington, D.C. based research institute and library. The microfiche collection is accompanied by Military Uses of Space: 1946-1991 Guide and Index.

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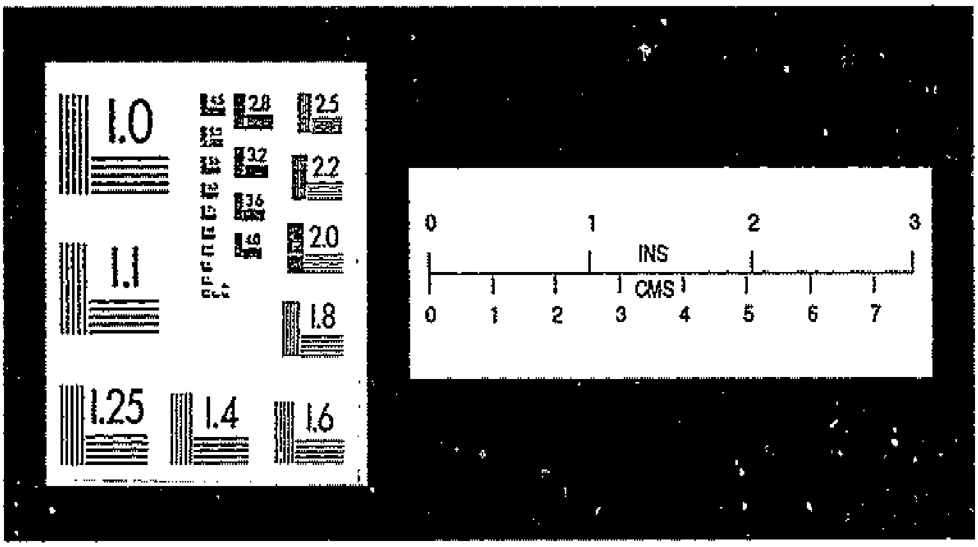

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PARCS Operations and Mai. re ance Contract

The PARCS Operations and Maintenance (O&M) contract went competitive for the first time in FY 79. The contract was awarded to Federal Electric Corporation. The FY 79 contract was for $6.8 million and $4.8 million in FY 80 and FY 81. The FY 78 contract had been for $14 million, so a significant savings was achieved by making the contract competitive.[146]

COBRA DANE

Cobra Dane was a long range L-band phased array radar AN/FPS-108 at Shemya AFS, Alaska. Its purpose was to obtain data on Soviet missiles launched from interior Russia and impacting in the Kamchatka Peninsula and in the broad ocean areas. It also performed missile warning support and was a collateral Spacetrack sensor. Cobra Dane replaced the AN/FPS-17 Detection Radar and the AN/FPS-80 Tracking Radar. Their final disposition had not been determined at the end of 1978. Following a series of tests and evaluations, ESD turned Cobra Dane over to ADCOM on 13 July 1977. An ESD Interim Operational Capability (IOC) was declared 13 July 1977.[147] Cobra Dane seemed almost trouble free with only two remaining anomalies at the end of 1978.[148] The O&M contract was negotiated as a competitive bid for the first time in FY 79. The winning prime contractor was Raytheon Service Division, Raytheon Corporation, Wayland, Maryland. The contract was for $4.7 million, a savings from the FY 78 contract of $8.9 million.[149]

Integrated Operational NUDET Detection System

The Integrated Operational NUDET Detection System (IONDS) was to provide surveillance and warning of nuclear detonation (NUDET) worldwide. Joint Strategic Capabilities Plan (JSCP) 77 tasked ADCOM with the requirement. IONDS would consist of NUDET detection sensors on 24 Global Positioning System (GPS) satellites,

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mission 3 sensors on the DSP satellites, and worldwide net of ground receiving/processing stations.[150] Full Operational Capability (FOC) was programmed for FY 86,[151] but technical problems and budgeting constraints slipped the program from 18 to 36 months.[152]

On 19 August 1977, ADCOM published Required Operational Capability (ROC) 4-77, for an Improved NUDET Surveillance and Reporting System (U). The ROC advocated the development and deployment of nuclear detonation sensors on the GPS satellites and improved NUDET sensors of the DSP satellites. In the ROC, ADCOM stated that because of the worldwide deployment of U. S. forces, the increasing number of nuclear-capable countries, and the increasing possibility of a nuclear exchange between countries other than the U. S. and the Soviet Union, coverage was required of the CONUS, Sino-Soviet Bloc countries, and USEUCOM and USPACOM area with emphasis on the Northern Hemisphere; however, the surveillance system had to be capable of rapidly expanding coverage for other threat areas. Worldwide NUDET surveillance coverage and reporting would be achieved by integrating the NUDET observations from the GPS and DSP satellites to ground terminals, thus a high degree of survivability was essential for both satellites and ground stations. From its experience gained from DSP, and because it conducted surveillance and reporting of nuclear bursts worldwide, ADCOM recommended in its ROC that it manage and exercise overall command and control of the system. IONDS was to have a reporting capability in the late 1980s. Cost of the IONDS (development plus 10 years of operations and maintenance) was estimated to be $120 million. This cost did not include communications requirements and IONDS receivers and processors on the airborne command post aircraft, which were estimated to be $150 million.[153] The Air Staff validated the ROC on 19 December 1977. Although ADCOM wanted to be the primary manager and exercise overall command and control over the system, Air Staff advised ADCOM that the primary operator would not be decided until DSARC II scheduled for May 1979.[154]

On 23 June 1977, the First GPS Test Satellite (NTS-2) was successfully launched.[155] The test showed that there would be no adverse effect of the additional IONDS weight on the GPS vehicle. Tentatively, the first GPS vehicle carrying an IONDS payload will be Flight Service Vehicle-6 (or FSV 6/GPS-6) scheduled for 1980.[156]

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Missile Warning Center

The JCS identified missile warning and attack characterization as a primary NORAD/ADCOM mission. Missile warning and attack characterization inputs were transmitted from missile warning sensors such as DSP, BMEWS, PARCS, and SLBM to the Missile Warning Center (MWC) in the NCMC. At the MWC, an attack assessment was made by CINCNORAD/CINCAD. If a missile attack was determined to be eminent, warning was relayed via high speed data circuits to the NMCC, ANMCC, the Defense Intelligence Agency (DIA); Commander in Chief, SAC; and the National Defence Headquarters (NDHQ). Teletype served as a backup and also routed information to additional users such as the ADCOM Alternate Command Post (ALCOP); 8th Air Force; 15th Air Force; NEACP; Commander in Chief, Atlantic Command (CINCLANT); Commander in Chief, Pacific Command (CINCPAC); and the U.S. Commander in Chief, Europe (USCINCEUR).[157]

A missile warning study was conducted during 1977; and in March 1978 USAF briefed ADCOM on its results. Generally, the study dealt with programs to upgrade warning systems such as PAVE PAWS, EPARCS, BMEWS improvements, and DSP modifications. ADCOM was satisfied with the progress of these programs, but felt that the study should have directed more effort toward the NCOC software and communications changes to accomodate the greater quantity and quality of data supplied by the sensors.[158] To add emphasis to tactical warning, USAF established a special project called Seek Options.[159]

Seek Options

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Attack Characterization and Attack Assessment

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CHAPTER V

SPACE SURVEILLANCE AND WARNING

Space Defense Center

An integral operational element of The Aerospace Defense Command (ADCOM)/North American Air Defense (NORAD) Command was the Combat Operations Center (COC) in the NORAD Cheyenne Mountain Complex (NCMC). The COC, located in Cheyenne Mountain, south of Colorado Springs, provided the Commander in Chief, Aerospace Defense Command (CINCAD) with the means of exercising operational command and control over all assigned or allocated forces. The COC consisted of a command post and seven operational support centers, one of which was the Space Defense Center (SDC). The other six were: the Weather Support Unit, the ADCOM Intelligence Center (ADIC), the Status and Surveillance Center, the Battle Staff Support Center (BSSC), the Missile Warning Center (MWC), and the Telecommunications Center. The SDC, composed of operational and computational facilities, provided CINCAD the capability to discharge his responsibilities in space defense operations. Associated with the SDC was the NORAD Space Detection and Tracking System (SPADATS). SPADATS received inputs from the USAF Spacetrack System, the U.S. Navy Space Surveillance (NAVSPASUR) system, the Canadian Forces (CF)/NORAD Satellite Tracking Units, the Ballistic Missile Early Warning System (BMEWS), and other collateral and contributing sensors. An ADCOM Alternate Space Defense Center (ASDC) was located at the 20th Surveillance Squadron (SurvS), Eglin Air Force Base (AFB), Florida.[1]

In 1977, the Union of Soviet Socialist Republics (USSR) launched 286 missiles and the United States of America (USA) 68. The USSR launched 98 earth satellite vehicles (ESV) and the USA 98.[2]

In 1978, the Union of Soviet Socialist Republics (USSR) launched 360 missiles and the United States of America (USA) 91. The USSR launched 88 earth satellite vehicles (ESV) and the USA 31.[3]

Space Object data is compiled in a chart on the following page. Although space watchers were concerned about the increasing number of items in orbit cluttering space, they were more concerned about the consequences of objects surviving re-entry of the atmosphere and colliding with the earth. They rarely did and then usually the

SPACE OBJECT DATA

	Objects Catalogues	Launches	Pay-loads	U.S. Pay-loads	USSR Pay-loads	Other Nations	Object Decay	Net Gain Over Previous Year
1974	579	106	122	20	91	11	-	132
1975	929	125	151	28	109	14	-	431
1976	1117	128	161	32	122	7	-	445
1977	902	124	136	19	105	12	523	379
1978	629	124	161	30	119	12	520	109

SOURCE: Data compiled by ADCOM/OI, as of January 1979.

pieces fell into the oceans, but in early 1978 one beat the odds and fell on Canada. To complicate matters it had been launced with a nuclear power source on board.[4]

Morning Light, the Decay of Cosmos 954

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The tracking and cleanup operations were given the code name "Morning Light."[7]

Interest in Cosmos 954 increased dramatically when it was announced to the Canadian Parliament that very soon a nuclear source would likely land some place in Canada. As the impact could not be prevented, Parliament wanted to know what precautions should be taken. The Canadian news media interviewed various Canadian government officials to learn why Canada had not been informed earlier of the nuclear threat. Prime Minister Pierre Trudeau claimed he had not been informed. Canadian Defence Minister Barnett Danson stated that NORAD had not informed Canada of this potentially dangerous situation. In response to the statements by Prime Minister Trudeau, Danson, and numerous articles in the Canadian press, General James E. Hill, went to Ottawa on 30 January 1978 to answer questions presented to him by the Canadian House of Commons. Prime Minister Trudeau had been informed of the impending decay of the Soviet Satellite during the Prime Minster's visit to Headquarters NORAD and the NORAD Cheyenne Mountain Complex (NCMC) on 28 December 1977. General Hill continued that Prime Minister either did not understand the significance of the satellite or the fact that it might impact on Canadian soil. Further discussion centered on whom should have been notified (Canadian Deputy Prime Minister Allen MacEachen complained that he and all of Canada were not forewarned as well as they should have been), and the belief that Russia should have also warned the world of the impending crisis. After General Hill met with the Canadian House of Commons fault finding with regard to U.S. and NORAD handling of the matter became less strident. Prime Minister Trudeau remembered the briefing at the NCMC.[8]

As mentioned earlier, b1

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b1 There-
fore, even after re-entry impact was confirmed, on 24 January 1978, it took a specially equipped C-130 one day to locate the debris in a sparcely inhabited area southeast of the Great Slave Lake in the Northwest Territories.* Nuclear response teams using geiger counters entered the area and found several radioactive bits, the hottest being 500 RADS/HR. This was a Beryllium rod from the reactor core. This lead Canadian and U.S. officials to conclude that the uranium load had not completely disintegrated during re-entry. USSR officials claimed the reactor was designed to self-destruct to preclude any radio-active contamination.[10] The Russians also claimed there had been two incidents when U.S. space vehicles had impacted on Soviet territory and that these incidents had been quietly and effectively handled by them with no publicity. The U.S. Embassy in Moscow requested clarification if indeed two space vehicles had impacted in Russia.[11] The Joint Chiefs of Staff (JCS), using NCOC data, informed the U.S. Embassy that there was no record of any Soviet reports of U.S. satellites impacting on their landmass. There was no way that the U.S. could confirm that a satellite had actually hit the ground unless someone found pieces and these findings were reported to the U.S. No such reports had been made.[12]

An ice runway was prepared at Cosmos Lake and several C-130s and helicopters with men and equipment went to the area to begin a massive cleanup operation under very harsh conditions. Morning Light was terminated and operations were completed 17 April 1978.[13]

Even though Morning Light was completed, the Canadian House of Commons and the news media continued to discuss the problems of warning, population alert and information, precision in prediciting impact area, and national responsibility. A 1976 United Nations treaty had laid responsibility for the re-entry of an object and payment for any damages caused by its re-entry upon the nation which had put it in orbit. A bill for part of the over $14 million cleanup was submitted by Canada to the USSR through the United Nations and is awaiting judgement. Another opportunity seemed possible with the decay of the U.S. Skylab, predicted to re-enter the atmosphere perhaps as soon as June or July 1979.[14]

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*When Cosmos 954 re-entered the atmosphere, prior to its actual impact, the NCOC/Missile Warning Crew passed "Great Slave Lake" to the NORAD Command Director as a geographical reference for the predicted impact point.

Skylab Decay Predictions

Skylab had been launched on 14 May 1973 as an unmanned Orbital Workshop (OWS). As the name implied, Skylab was designed to conduct experiments from a laboratory in space. The experiments were categorized as solar physics, earth resources, life sciences, material science, the Skylab student project, and other experiments. By February 1974, all scheduled flight objectives had been accomplished, plus other objectives added as the program progressed. In August 1977, the National Aeronautics and Space Administration's (NASA) Marshall Space Flight Center (MSFC) requested ADCOM perform an independent life time prediction on Skylab. MSFC studies indicated that Skylab might be difficult to retain in orbit and that the satellite might decay in the near future.[15] Although Skylab had no nuclear source on board, it posed a serious threat to life and property if it landed in a populous area because the vehicle was 118 feet long and 21.6 feet in diameter and weighed 85 tons.[16]

ADCOM confirmed that the satellite might decay earlier than expected because of solar activity and satellite drag.[17] To extend Skylab's life expectancy the orientation of the spacecraft was changed by activating its batteries and repositioning the satellite to reduce drag. ADCOM decay predictions placed re-entry possibilities sometime between June 1979 and April 1980.[18] Everything possible was being done to keep the satellite aloft but decay predictions were becoming more pessimistic.[19]

Pegasus I Decay

On 11 September 1978, NASA's Marshall Space Flight Center (MSFC) requested ADCOM's COC to monitor the decay of Pegasus I--at 23,000 pounds the largest object so far to enter the earth's atmosphere.[20] At minus 6 hours to the point of decay, ACOC provided real-time locations of predicted decay points. The ACOC qualified their support with, b5

Supplying you with impact confirmation is contingent on our receiving impact reports."[21] For Pegasus I,

b5

On 17 September 1978, the SDC reported that Pegasus I had decayed in the earth's atmosphere at 0612Z near the Equator and the Coast of Africa over the Atlantic Ocean. No pieces were found.[23]

Tracking and Impact Prediction

Following Cosmos 954 impact on Canadian soil increased attention was given to ADCOM/NORAD's ability to provide information regarding the existence of nuclear material on a satellite, the weight and mass of the object and the probability of its surviving re-entry. The possibility of Skylab impacting on land added to the interest. The Joint Chiefs of Staff made two separate inquiries within a short time of each other.[24] ADCOM replied that tracking and impact prediction information was routinely available. Close monitoring of decaying objects began normally as early as 30 days prior to the predicted decay date with an average of 20 computer runs made through the post decay prediction. Accuracy of decay predictions was due to gaps in sensor coverage, atmospheric density uncertainties, and satellite attitude anomalies. A time confidence window was therefore assigned to each decay prediction.

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ADCOM could not confirm if an object actually survived re-entry unless pieces were recovered and it was notified. ADCOM continued that detailed information would be available and routinely supplied on all decaying objects.[25]

The Space Detection and Tracking System

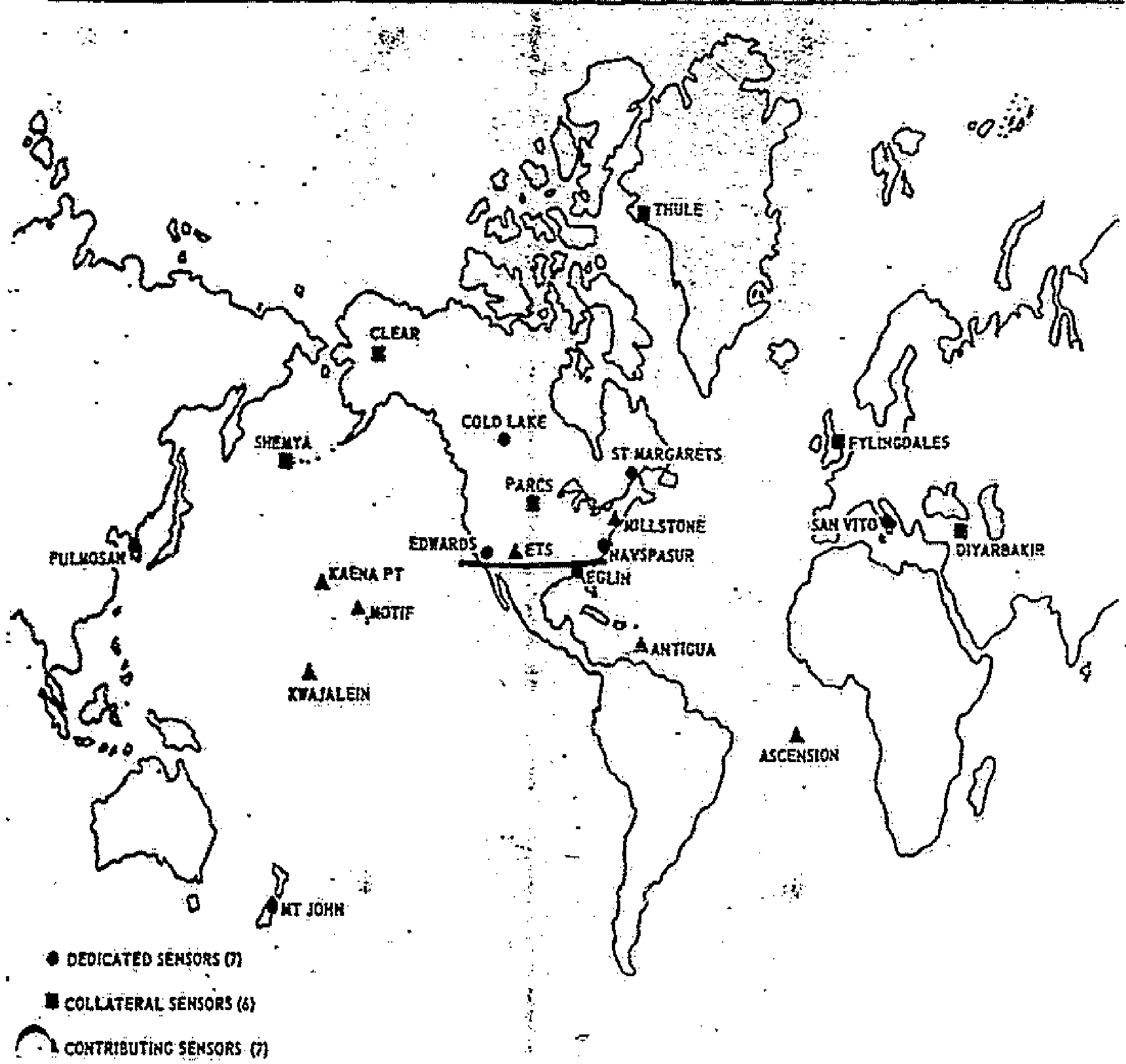
Space surveillance, tracking and detection were performed primarily by the Space Detection and Tracking System (SPADATS). Its mission was to: (1) detect, track, identify, and catalog all man-made objects in space; (2) provide sensor information on foreign activities to CINCNORAD; and (3) support other Canadian and U.S. agencies as required. SPADATS consisted of the Space Defense Center (SDC) the USAF Spacetrack system; the U.S. Naval Space Surveillance System (NAVSPASUR); Canadian Baker-Nunn cameras and SOI telescopes; the Alternate Space Defense Center at Eglin AFB, Florida; and various collateral and contributing U.S. military and scientific sensors. The SPADATS network contributed satellite catalogue and Space Object Identification (SOI) data.[26]

USAF Spacetrack

The USAF contribution to SPADATS was called

SPACE DETECTION AND TRACKING SYSTEM
(SPADATS)

31 December 1979



THE NORAD SPACE DETECTION AND TRACKING SYSTEM (SPADATS)
1 January 1977-31 December 1978

Site	Unit	Equipment
Cheyenne Mountain CO	NORAD/ADCOM Combat Operations Center	Space Defense Center
Cold Lake, Alberta (SATTU)	Canadian Forces	Baker-Nunn Optical Sensor
St Margarets, New Brunswick (SITU)	Canadian Forces	Baker-Nunn and 24" SOI Telescope
Dahlgren, VA and Southern U. S.	U.S. Navy Space Surveillance System	Computational Center and Sensor

THE USAF SPACETRACK SYTEM
1 January 1977-31 Dec 1978

Pirinclik CDI, Diyarbakir, Turkey	19th Surveillance Squadron (TUSLOG Det 8)	AN/FPS-17 and AN-FPS-79 ((returned to operation on 26 October 1978.)
Edwards AFB, CA Sand Isl, Johnston Atoll San Vito AS, Italy Mt John, New Zealand	Bendix Field Engineering Corp and Joseph Nunn Associates (contractors	Baker-Nunn Optical Sensors (telescope-camera space observation system)

SPADATS CONTRIBUTING SENSORS
1 January 1977-31 December 1978

Ascension Island	Air Force Eastern Test Range (AFETR)	FPQ-15 Tracking Radar (TR)
Antigua Island	AFETR	FPQ-14 TR
Kaena Point, HI	Air Force Western Test Range (AFWTR)	TR
Kwajalein Atoll	Pacific Missile Range	TR
Millstone Hill, MA	MIT Lincoln Laboratory	TR
White Sands, NM	MIT Lincoln Laboratory	GEODSS Optical Sensor prototype model

Site	Unit	Equipment
Cloudcroft, NM	SAMSO	Optical Sensor
Malabar, FL	AFETR	Optical Sensor
Maui, HI (AMOS)	Advanced Research Projects	Two 48" telescopes and one 1.6 meter telescope

The Smithsonian Astrophysical Observatory network of 11 Baker-Nunn cameras and the National Aeronautics and Space Administration also provided data.

SPADATS COLLATERAL SENSORS
1 January 1977-31 December 1978

Shemya AFB, Alaska	16th Surveillance Sq	FPS-17 Detection Radar (ceased operation 1 August 1977.) FPS-80 TR (ceased) operation 1 August 1977.) FPS-108 Phased Array Radar (IOC achieved 15 July 1977.)
Clear AFS, AK	Ballistic Missile Early Warning System (BMEWS)	1 FPS-50, 1 FPS-92
Thule AB, Greenland	BMEWS	1 FPS-50 Detection Radar, 1 FPS-49 TR
Fylingdales, U.K.	BMEWS	3 FPS-49 TRs
Eglin AFB, FL	20th Surv Sq, SLBM Warning System, Alternate SDC	FPS Phased Array Radar and peripheral data processing equipment
Concrete, ND	Perimeter Acquisition Radar Attack Characterization System (PARCS)	Phased Array Radar
Satellites	Defense Support Program	

SOURCE: NORAD Forces and Program Change Summary (S-Revw-98), 1 Jan 79 (24.2).

Spacetrack. It consisted of the AN/FPS-17 and AN/FPS-79 radars at Diyarbakir, Turkey; and four Baker-Nunn cameras located at Edwards AFB, California; San Vito Air Base (AB), Italy; Mount John New Zealand; and Pulmosan, Korea.[27]

U.S. NAVSPASUR

The U.S. Navy NAVSPASUR consisted of a Data Filtering and Processing Facility at Dahlgren, Virginia; and three transmitter and six receiver sites located along a great circle between San Diego, California; and Savannah, Georgia. The transmitters were at Jordan Lake, Alabama; Kickapoo Lake, Texas; and Gila River, Arizona. The receivers were at Fort Stewart, Georgia; Silver Lake, Mississippi; Elephant Butte, New Mexico; San Diego, California; Red River, Arizona; and Hawkinsville, Georgia. The system remained much the same during the 1977 and 1978 as it had since modification in the 1960s.[28]

Canadian SPADATS Contribution

Canada contributed two Baker-Nunn cameras to SPADATS. The cameras were located at Cold Lake, Alberta; and St Margarets, New Brunswick. A 24 inch SOI telescope became operational (referred to as having a photometric SOI capability) at St Margarets on 4 October 1978.[29] During August, the camera at Cold Lake was down due to focus problems. Delays in returning the camera to operational status occurred because of cloudy weather, Northern Lights, and various minor mechanical problems, but it was operational again the end of August.[30]

Contributing Sensors

Seven contributing sensors served SPADATS. These were the Millstone Hill (Lincoln Laboratory, Massachusetts Institute of Technology, Massachusetts) tracking radar; Ascension Island (Air Force Eastern Test Range) AN/FPQ-15 tracking radar; Antigua Island (Air Force Eastern Test Range) AN/FPQ-14 tracking radar; Maui, Hawaii, Advanced Research Projects Agency (ARPA) two 48 inch and one 60 inch telescopes; Kaena Point, Hawaii (Air Force Western Test Range) tracking radar; White Sands, New Mexico/ Lincoln Laboratory (GEODSS) Optical Sensor Experimental test site/GEODESS optical sensor; the U.S. Army tracking radar at Kwajalein Atoll in the Pacific; Cloudcroft, New Mexico (Space and Missile System Organization) optical sensor; and Malabar, Florida (Air Force Eastern Test Range) optical sensor. The contributing sensors were augmented by 11 Smithsonian Astrophysical Observatory (SAO) Baker-Nunn cameras and NASA sensors.[31]

Collateral Sensors

Although b1

they did support the ADCOM Spacetrack surveillance mission by tracking satellites on a secondary mission. The six collateral sensors were the three Ballistic Missile Warning System (BMEWS) sites (Thule Air Base, Greenland; Clear Air Force Station, Alaska; and Fylingdales, United Kingdom); Cobra Dane at Shemya, Alaska; the AN/FPS-85 at Eglin AFB, Florida; and the Perimeter Acquisition Radar Attack Characterization System (PARCS) at Concrete, North Dakota. Satellites of the Defense Support program supplied data on space launches.[32]

Spacetrack Sensors

Spacetrack Radars at Diyarbakir

ADCOM operated as part of the Spacetrack system an AN/FPS-17 Detection Radar (DR) and an AN/FPS-79 Tracking Radar (TR) at the Pirinclik Common Defense Installation (PCDI) near Diyarbakir, Turkey.

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The radars had been shut down in July 1975 and remained inactive until October 1978.

Events leading to the inactivation of the radars of Detachment 8 had their beginning on the Island of Cyprus. The Greek Cypriot and Turkish Cypriot communities had carried on a long feud over which group should control the government and the island. On 12 July 1974, the Cypriot National Guard, led by 650 regular Greek Army officers, seized power from Archbishop Makarios, who had been the President of Cyprus since 1960. Then on 20 July 1974, ostensibly to protect the Turkish Cypriot population, Turkey made an amphibious landing on the island citing her legal responsibilities as a co-guarantor of Cypriot independence. After some fighting a cease fire was arranged.

As an ally of both countries, the U.S. was caught in the middle. Greece blamed her for allowing the Turks to invade, and Turkey blamed her for not supporting its actions against the Greeks. Both countries belonged to the North Atlantic Treaty Organization (NATO) and were important to U.S. national interests in the

western Mediterranean area. Maintaining a neutral stance was not an option for the U.S. The highly organized Greek-American community (about 3,000,000 vs about 100,000 Turks) began to lobby in the Congress, urging the U.S. impose an arms embargo upon Turkey. The Congress passed an arms embargo bill despite two presidential vetoes. After last-ditch efforts by the administration to stop the embargo bill; and additional attempts to lift the embargo by the administration and some individuals in the House and Senate, the bill became law and went into effect on 24 July 1975. On 25 July 1975, the Government of Turkey announced that the actions by the U.S. had voided the 1969 Defense Cooperation Agreement and that it was placing U.S. Forces under "Provisional Status." Operations at U.S. installations in Turkey were suspended on 27 July 1975. As directed by Turkish government officials ADCOM representatives removed a portion of the AN/FPS-79 tracking antenna wave guide.[33] A caretaker force of two Air Force officers, 8 airmen, and 60 General Electric contractor personnel remained at the site awaiting instructions to reactivate it.[34]

Reactivation of the Diyarbakir Site

They were not soon in coming, and negotiations dragged on. In the meantime a restart plan was developed whereby General Electric personnel would return the system to full operations within 15 days. Temporary duty personnel from ADCOM would then deploy to Diyarbakir to operate the equipment until permanently assigned personnel arrived.[35] The Turks permitted the AN/FPS-79 tracking antenna wave guide to be reinstalled on 14 October 1976. This made it easier to maintain the equipment as the General Electric personnel could then perform checkouts and calibration of the overall system, and it helped reduce system deterioration. This would help expedite return to operations whenever reactivation was authorized.[36]

A new U.S. Government of Turkey bilateral agreement was signed in Washington on 26 March 1976. Department of State officials were optimistic that once the Congress approved the agreement, and the Turkish Cabinet and a formal exchange of Notes for Agreement implementation had occurred, the restriction on operations would be quickly removed.[37] This was not the case, however. The Government of Turkey wanted the arms embargo lifted; and until the U.S. did so, the sites would not be reactivated.[38] Doubt increased that the site would ever be reopened. ADCOM discussed with USAF the feasibility of establishing another Spacetrack site in the Middle East. Sites were

surveyed in Iran and Pakistan.[39] In the meantime, however, the U.S. Congress, in October 1978, voted to lift the arms embargo. Within a few days, the Government of Turkey informed the State Department that operations could begin at the Turkish sites. The U.S. Secretary of State sent official authorization to Headquarers ADCOM on 11 October 1978, and the radars,[40] both the FPS-17 and FPS-79, were operational on 260500Z October 1978, 16 days after notification. On 26 November 1978, 24 hours-a-day operations began, 9 days ahead of schedule.[41] Round the clock operations continued through the end of 1978 with no major technical problems.[42]

Television Interference at Diyarbakir

With the reactivation of the radars returned an old nemesis, television electromagnetic interference (EMI) emitted from the Spacetrack radars at Diyarbakir. Interference had been a public relations problem since 5 June 1954, when the Turkish television station in the Diyarbakir area began transmitting. By the end of June, the mass of complaints had become so great that the site shut down the radars during peak television viewing hours. The Chief, Joint U.S. Military Mission for Aid to Turkey (JCUSMMAT) was concerned that agitation over the interference would jeopardize the whole U.S. military presence in Turkey. Actually the key issue was the arms embargo and not TV interference.[43]

b1 This stop gap solution did not resolve the problem--but it did reduce the number of complaints.[44] Complaints stopped only when the radars entirely shut down in July 1975. With the reactivation in October 1978, the problem of interference would be even greater than it had been in 1975 because the area now had nine more television transmitters, and more planned.[45] The TUSLOG Det 8 commander informed ADCOM that, "it is obvious that TV is going well in this part of Turkey. Therefore, we can expect the interference problem to become serious in the future. The only real solution is to b1 as soon as possible."[46]

When the interference problem had first arisen three solutions were offered. The first was to replace the FPS-17 with another radar, an expensive and time consuming operation. The second option was to move the site out of the country. Although this option had certain merits, given the political instability of the

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Turkish government,

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But then the best replacement locations, Iran, Pakistan, and Afghanistan, were also characterized by governmental instability. The third option, b1 frequency band, seemed to be the most cost effective and feasible.[47] Excess parts from the Safeguard Perimeter Acquistion Radar were available to reduce the cost. The parts were in storage at the General Electric Plant, Syracuse, New York. The cost was estimated at $7 million, and the work could take 20 months from contract to completion. General Electric proposed a $35,000 pre-engineering study which would reduce completion time to 15 months, but the Air Staff preferred to await the political outcome. Following the resolution of the political situation in late 1978, b1

Shemya Spacetrack Site

With Diyarbakir not yet operational and the site for Cobra Talon still not chosen, Cobra Dane at Shemya AFB, Alaska, was the only one of three Spacetrack radar sites operational throughout 1977 and 1978, and it was only a collateral sensor. The Cobra Talon Spacetrack radar at Ko Kha Air Station, Thailand, had been closed on 31 May 1976, when negotations with the Government of Thailand failed and U.S. forces were asked to leave the country. The Cobra Talon AN/GPS-10 radar was packed and stored in the Philippines awaiting disposition.* As discussed earlier, the Spacetrack radar at Pirinclik Common Defense Installation near Diyarbakir, Turkey, had been closed down by the Government of Turkey from July 1975 to October 1978.

Construction of Cobra Dane/AN/FPS-108

Construction of Cobra Dane/AN/FPS-108 Phased Array Radar was awarded to Raytheon Corporation on 6 June 1973. The Cobra Dane building foundation was completed in October 1973 and work began on the structure in May 1974. Installation of equipment began in 1975. The first detection of a satellite was accomplished on 27 December 1975. Raytheon turned the radar over to Electronics Systems Division (ESD) in October 1976. ESD completed its series of tests and evaluations and turned Cobra Dane over to ADCOM on 13 July

* See discussion later in this chapter on the Pacific Radar Barrier.

1977.[49] Interim Operational Capability (IOC) was not achieved in the 1977-1978 time frame (nor in early 1979) as ADCOM would not declare IOC until all Class I and II anomalies present at the turnover had been cleared.[50]

Inactivation of the AN/FPS-17 and AN/FPS-80

Following completion of the ESD tests and evaluation of the Cobra Dane equipment, the AN/FPS-17 and AN/FPS-80 radars and equipment at Shemya became excess, and on 1 August 1977, they were turned off. The FPS-17 had been operational since May 1959, and the FPS-80 since April 1962. They had maintained a high rate of proficiency. In February 1975, a major earthquake caused severe damage to the system, but within 8 days the radars had returned to full operation.[51]

The FPS-80 was packed and crated in the summer of 1977. Some electronic equipment was sent to Lincoln Laboratory, Hanscom AFB, Massachusetts in July 1978. The FPS-17 was packed and crated in 1978 awaiting disposition. Shelters for both radars and the large FPS-80 antenna were still standing at the end of 1978.[52] Environmental aspects--if the antenna and shelters were dismantled and left lying on the island, or the cost of backloading the debris of the structures to the U.S.--had to be resolved before additional action was to be taken.[53]

The Pacific Radar Barrier

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The key to the selection of the sites rested with the location of the AN/GPS-10 radar, formerly located at Ko Kha Air Station, Thailand. The GPS-10, referred to as Cobra Talon when it was operated by the 17th Radar Squadron in Thailand, had been dismantled in 1976 and placed in storage at Clark AB, Philippines. The electronic components were stored in an environmentally controlled warehouse, but the antenna had been stored outside and exposed to the elements. The Real Property Installed Equipment (RPIE) was stored at Subic Bay Naval Base. ADCOM was concerned that unless something was done with the radar, especially the antenna, in the near future, it would be completely useless. PACBAR decisions, however, were slow in coming.[55]

After a number of locations had been surveyed for the GPS-10, San Miguel Naval Communications, Philippines, was selected as the best site. Negotiations with the Government of the Philippines encountered difficulties, however, when the Department of State attempted to tie together GPS-10 and San Miguel argeements with the 1947 Base Rights Agreements. The 1947 Base Rights Agreements renegotiation concerned several other bases and facilities besides the GPS-10/San Miguel operations.[56] Anxious to speed up negotiations, especially since the GPS-10 was deteriorating in the tropical weather, ADCOM recommended that the negotiations for San Miguel be separated from the 1947 Base Rights Agreements.[57] It urged that if San Miguel rights could not be made a separate package from the new base rights agreements, the GPS-10 should be moved elsewhere. An additional survey was made of Guam and Australia, and Korea was considered;[58] but San Miguel remained the most acceptable site.[59] Little progress was made until November 1978 when USAF notified ADCOM that the GPS-10 could be activated at San Miguel "as a simple redeployment."[60]

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The second PACBAR site, on Guam, was to have a newly developed mechanical tracker.[63] ADCOM suggested, as a cost saving alternative, to use the FPS-80 radar dismantled and stored at Shemya. ESD, however, analyzed the FPS-80 and found it to be inadequate.[64]

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The third link in the PACBAR network would be the ARPA Long-range Tracking and Instrumentation Radar (ALTAIR) radar on Kwajalein Atoll. ALTAIR was a U.S. Army Ballistic Missile Defense Systems Command radar on Roi-Namur Island, Kwajalein Atoll.

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ALTAIR would be the eastern anchor for PACBAR.[67]

Baker-Nunn Cameras in Spacetrack

Four Baker-Nunn cameras served as optical sensors in the USAF Spacetrack system. These cameras were located at Edwards AFB, California; Mount John, New Zealand; San Vito, Italy; and Pulmosan, South Korea. In SPADATS, of which Spacetrack was the USAF element, two additional

Baker-Nunn cameras were located in Canada: one at Cold Lake, Alberta; and the other at St Margarets, New Brunswick. Since 1 July 1975, the operation and maintenance (O&M) of the USAF system had been carried out under a joint venture contract by Joseph Nunn Associates (JNA) and the Bendix Field Engineering Corporation. It was one of ADCOM's most successful contracts. The Canadian sites were manned and operated by Canadian Defense Force personnel.

Relocation of Sand Island Baker-Nunn Camera to Pulmosan, South Korea

The Sand Island camera had been in operation since 26 October 1963.[68] It had been placed there originally to support project 437,* but plans were made by ADCOM in 1974 to redistribute the Baker-Nunn cameras to provide more adequate global coverage of deep space satellites.[69] From site surveys, Pulmosan, Korea, a U.S. Army installation was selected from the site surveys as the most suitable site. In October 1976, Korea granted construction clearance, and a contract to move the camera was awarded to Bendix Field Engineering. The relocation begun 12 March 1977 when equipment departed Johnston Island on a Military Air Command (MAC) special flight, for Taegu, Korea, close to Pulmosan.[70] An Initial Operational Capability (IOC) was declared at Pulmosan on 15 May 1977.[71] After the correction of minor discrepancies, the site achieved full operational capability (FOC) on 23 June.[72]

Anchor Stomp

Anchor Stomp was special tasking of the Baker-Nunn cameras involving special surveillance of a group of Soviet satellites equipped with strobes which flashed at intervals, apparently triggered from the ground. In 1977, seven objects were observed as active and in 1978, seven again were observed.[73]

Deep Space Surveillance

Deep space was defined as the region beyond 5,600 kilometers well beyond the 3,000nm range of most radar sensors. Of special concern was the 22,300nm orbit of geosynchronous satellites. Both the U.S. and USSR used this orbit for communications and observation satellites because they were stationary, matching the rotation speed of the earth and remaining above one point on the

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globe.

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A change in deep space tasking had developed over the last two years. Previously, there was a blanket tasking on all deep space objects to all deep space sensors. In December 1977, ADCOM deleted the tasking on those routine domestic synchronous satellites which were controlled by a cooperating agency such as NASA. Then in November 1978, ADCOM reduced the tasking by being more selective on the objects in the deep space realm; that is, because NAVSPASUR and the AN/FPS-85 at Eglin AFB could routinely track some of the objects at certain points in their orbit, tasking of these satellites was reduced.[74]

Improvements to Space System

Improved Space Surveillance

The current SPADATS was seriously limited in coverage, accuracy, timeliness, and target signatures. SPADATS needed to be upgraded to support current and future military space operations. Research and development (R&D) programs were ongoing to improve the Navy Space Surveillance capability b1 and the USAF Spacetrack system over a b1 time period.[75]

Advanced Space Defense Program

The Advanced Space Defense Program (ADSP) included a number of improvements to USAF Spacetrack. Some were being developed while others were in the planning stages. They included the Pacific Radar Barrier (PACBAR), the Ground-based Electro-optical Deep Space Surveillance System (GEODSS), Space-Based Long Wavelength Infrared (LWIR) Sensor, DSP Handoff, and Space Object Identification (SOI). Other programs were also being explored to extend the range, improve accuracy, and efficiency of orbit predictions, and improve radar calibration capability.[76]

Ground-based Electro-Optical Deep Space Surveillance

The Ground-based Electro-Optical Deep Space Surveillance (GEODSS) system was a surveillance system for detecting and tracking objects in deep space; i.e., beyond 3,000nm out to and well beyond 22,000nm. GEODSS would employ television cameras mounted on telescopes to detect and track satellites by observing sunlight

reflected from the object. Each GEODSS site would consist of two 40 inch and one 15 inch aperture telescope for deep space and low light level television camera for each telescope, radiometers (SOI) associated digital computers, control consoles, and communication equipment. Five sites would be placed around the globe to assure complete space coverage. Two sites had been selected in the United States, one at the Stallion Range Center, White Sands Missile Range, New Mexico; and the other at Mount Haleakala, Maui, Hawaii. Projecting from these two sites, the other sites were plotted.[77] A location at Choejonjsan, near Taeju, Korea, was selected to the West of Hawaii.[78] East of the United States, negotiations with the Government of Morocco were being conducted to locate a site in that country.[79] To complete the encirclement of the globe, a location in Iran had been considered.[80] Negotiations with the two countries developed complications when site surveys could not be arranged with the Government of Morocco and the internal political situation in Iran deteriorated into complete turmoil.[81]

In May 1977, ADCOM personnel assigned to the Experimental Test Site (ETS) for GEODSS located at Stallion Range Control Center finished a functional Initial Operational Test and Evaluation (IOT&E). The IOT&E was performed to prove the GEODSS technological feasibility. ADCOM personnel reported that the equipment exceeded research and development requirements.[82] Further testing and operational shakedowns were conducted at Stallion during 1977 and 1978 with plans to extend the ETS until the CONUS GEODSS site had deployed. Tentatively, the second GEODSS site was to be Taegu, Korea.[83]

On 15 May 1978, Air Force Systems Command's (AFSC) Electronic Systems Division awarded a $33.4 million contract to Thompson-Ramo-Woolridge (TRW) Incorporated. The contract provided for three sites, equipment, installation, checkout, and testing with an option for the two other sites. The cost for the full five site system, plus operations, maintenance, and support for 54 months (6 months past turnover of the fifth site) was estimated to be $62 million.[84]

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Space Object Identification

Space Object Identification (SOI) was a task that ADCOM had assumed from AFSC in 1963. SOI data, when combined and analyzed with a satellite's orbital parameters, supported all space defense functions. Current SOI data had limitations. It was almost totally restricted to narrow band, noncoherent, radar signature analysis on objects below 5555km (3000nm). SOI data needed to be extended to at least geosynchronous altitudes to permit credible analysis of all objects in the threat environment. An improvement program called Target Signatures Program (TSP) had been initiated in 1976. A number of companies, such as General Electric, Hughes Aircraft Company, and AVCO, were developing and testing various surveillance and data processing techniques. The objectives of TSP were:[87]

1. Evaluate advanced SOI research and development projects of the Advanced Research Projects Agency (ARPA).

2. Incorporate promising SOI analysis technique and sensors.

3. Upgrade the ADCOM Intelligence Center to serve as a centralized facility to accomodate the various types of SOI data resulting from advancements in technology.

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Space Defense Command and Control System

The Space Defense Command and Control System (SPADCCS) was to become the command and control element for space defense forces and assets in the 1980 time period. On 29 June 1977, SAMSO released dual contracts to System Development Corporation (SDC) and Martin Marietta Corporation (MMC) for definition studies for a space defense command and control system. SDC completed their study in December 1978 and MMC was expected to complete their study in March 1979. SAMSO was to analyse the studies and develop future specifications for SPADCCS.[89]

Space Defense Operations Center

The Space Defense Operations Center (SPADOC) would be the single, integrated operations center for providing satellite attack warning b1

It was to be located in the NCMC. ADCOM ROC 5-76, SPADOC, was published 18 October 1976. Studies to define the requirements and operations concept of SPADOC began in December 1977. In October 1978, the Office of the Assistant for SPADOC Development and Acquisition was established. The studies were not complete by the end of 1978; but available results were being used to revise the requirements document, to revise the operations concept, and to prepare an implementation plan that described a phased approach to developing and implementing SPADOC. Phase I, to establish an early initial capability, was to begin in October 1979 and was to provide an early Space Defense Operations Center capability by modifying the 427M equipment currently in the NCMC. Thus on 1 October 1979, a fusion center would be implemented where key personnel would be operationally responsible for the control of space defense command, control, and communication (C3) functions that were to be colocated and were to function under the operational control of a single individual. In this way, SPADOC would become the control center for space defense operations.

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Satellite Attack Warning and Verification System

The Satellite Attack Warning and Verification System (SAWVS) was a software and display system being

developed for the computers in the ADCOM Intelligence Center in the NORAD Cheyenne Mountain Complex (NCMC).

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Initially referred to as the Satellite Attack Warning System (SAWS), the current IOC for SAWVS was 1979.[91]

Space Launch

10th Aerospace Defense Squadron

The 10th Aerospace Defense Squadron (AERODS) at Vandenberg AFB, California, was the only U.S. military space launch team. Personnel of the 10AERODS provided operational Thor booster launch support to Department of Defense satellite programs under the Air Force Space Support Program b1 The only satellite program currently being launched by 10AERODS was the Defense Meteorological Satellite Program (DMSP), a military meteorological satellite. Space Support Program assets included the launch facilities at Space Launch Complex Number 10 at Vandenberg AFB, California, and a total of 13 flight worthy Thor boosters in the USAF inventory. Seven of these boosters were Defense Meteorological Satellite Program (DMSP) space launch configured, with the remaining six held in storage to support future programs.[92]

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The Defense Meteorological Satellite Program

The mission of the Defense Meteorological Satellite Program (DMSP) was to provide timely global, visual, and infrared cloud cover data and other specialized weather information to Air Force Global Weather Central at Offutt AFB, Nebraska, in support of special strategic missions; and to provide real-time direct satellite readout of local area weather data to military terminals at key locations throughout the world. The spaceborne DMSP system consisted of at least two operational satellites in 450nm circular and sun-synchronous orbits around the poles of the earth. At the 450nm altitude, the orbital period

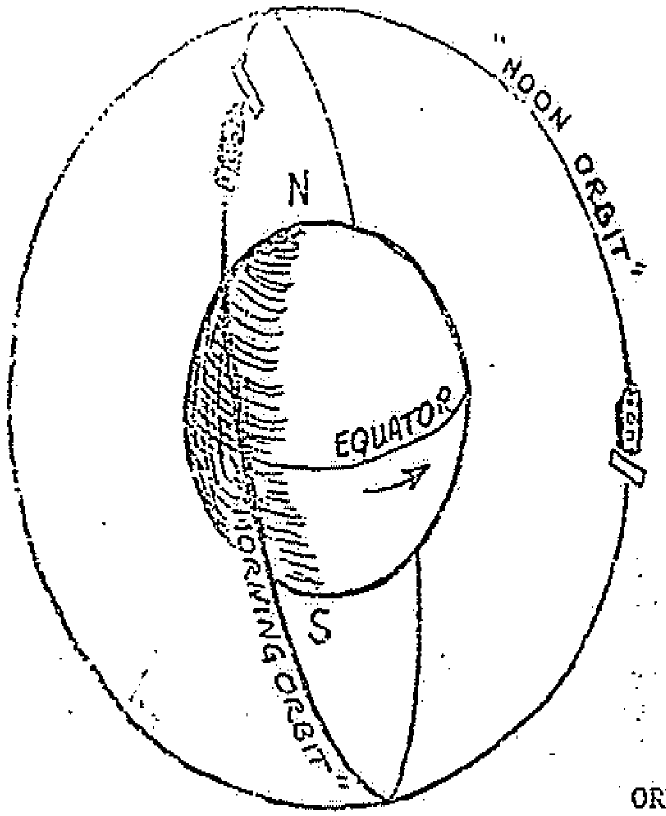
(time per revolution) was synchronized with the rotation of the earth in such a way that the satellites passed over each point on the surface of the earth at the same time (twice) each day. The orbits for the two satellites were referred to as the "morning orbit" and the "noon orbit." (see following page for illustration). A satellite in the "morning orbit" passed over earth points just after sunrise and just after sunset. The satellite in the "noon orbit" passed over the earth points at noon and midnight.[94]

The first DMSP satellite was launched in January 1965 by the 4300th Support Squadron (SAC). The 10th Aerospace Defense Squadron (ADCOM) began launching DMSP satellites in 1967. Since 1968, the 10th Aerospace Defense Squadron (AERODS) had launched 19 DMSP satellites.[95] Three DMSP satellites were significant during 1977 and 1978.

The three satellites were the first of a new model series. Model 5D replaced Model 5C. Model 5D was a more sophisticated satellite that incorporated changes that increased life span, supported larger and more numerous sensors, and provided for a near constant resolution of visible and infrared data.[96]

On 11 September 1976, F-1, the first Block 5D DMSP satellite, was launched. It lost stability soon after achieving orbit. For the next 5 months, actions were conducted to return the satellite to stability.[97] The process was described by a team of Air Force and Aerospace industrial engineers as being analogous to moving a bowling ball by bouncing a marble against it. The task was also equated to as using a 500-mile screwdriver to repair the satellite. In actuality, by using the interaction of onboard magnetic coils with the earth's magnetic field, the team was able to nullify the satellite's spinning momentum and bring it under control.[98] The satellite was turned over to the operating organization, the 4000th Aerospace Applications Group (SAC), on 1 April 1977; and the Air Weather Service declared the satellite IOC on 8 April 1977. In the meantime, the satellite developed problems with the recorders for the primary weather sensor and with the downlink transmitter antennas. In addition, all gyros on the satellite had failed requiring attitude control to be maintained through computer software. Inspite of all of the effort to stabilize the satellite, the problems were considered so detrimental to the system that the next scheduled DMSP satellite was readied to replace F-1.[99]

F-2, the second Block 5D DMSP satellite, was launched on 5 June 1977. It successfully reached orbit



DMSP ORBITS

NOMINAL DATA

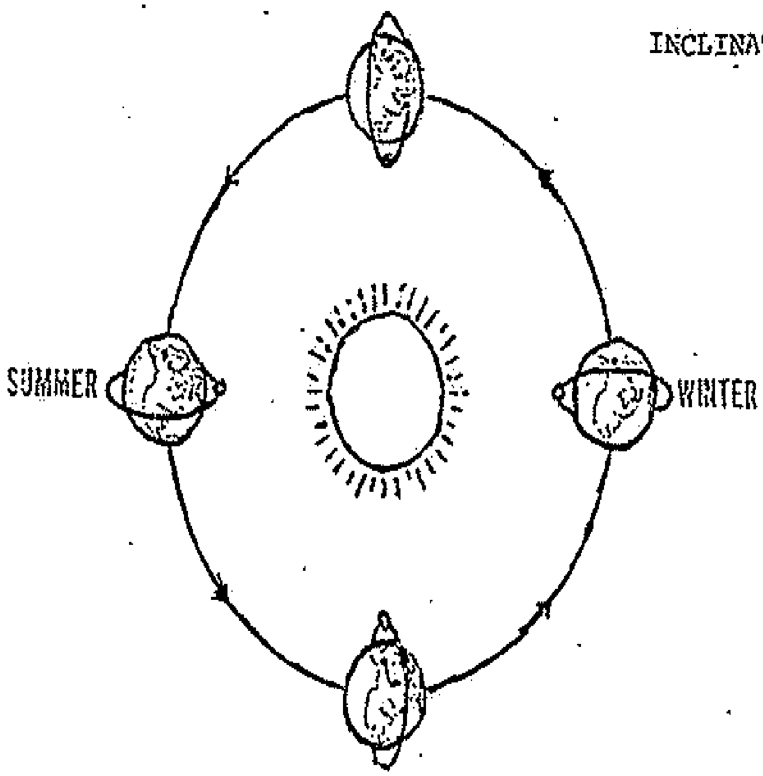
ORBIT - SUN SYNCHRONOUS;
NEAR POLAR

ALTITUDE - 450 N.M.

PERIOD - 101,65 MIN.

ECCENTRICITY - CIRCULAR

INCLINATION - 98.7 DEG.



A SUN SYNCHRONOUS ORBIT - The plane of the orbit rotates through 90° every three months, and the satellite's orientation to the sun does not change.

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and became an operating DMSP satellite. F-3 launched on 30 April 1978, was also successful, and became the nineteenth DMSP satellite.[100] The 10AERODS overall launch record to that time was 57 totally successful mission satellites in 38 Thor launches.[101] There were only two more launches planned in the current series: F-4, scheduled for 1979, and F-5, which possibly would be launched in 1979. Flight 6, planned for 1980, would be the first of the follow-on Block 5D-2 satellites. Block 5D-2 satellites would be launched using the SLV-2A model Thor boosters. In contrast to the current LV-2F Thor, the SLV-2A was augmented with three solid propellant Castor II rockets having 55,000 pounds of thrust each. The additional thrust was required to orbit the heavier satellites. Modifications required to launch SLV-2A boosters from the 10AERODS launch emplacement at Vandenberg's Space Launch Complex 10 West were planned to begin in the Block 5D-1 era in 1979.[102]

In September 1978, ADCOM was notified of a DMSP weight growth problem. This issue surfaced for the first time in a SAMSO briefing to General Hill and staff. SAMSO's view of the problem was that the weight of the Block 5D-2 satellites (flights 6, 7, 8 and 9) with new sensors would be too grdat to be placed into orbit by the THOR SLV-2A launch vehicle. SAMSO's solution to the problem was to use a contractor launched ATLAS booster for these missions. ADCOM did not agree with this proposal for a number of reasons, not the least of which was the fact that SAMSO's solution ignored an ADCOM space mission. Following extensive staff action and interface with SAMSO, AFSC, Hq USAF and contractors, the issue was resolved to ADCOM's satisfaction. DMSP would continue to be launched by the Tenth Aerospace Defense Squadron using the THOR launch vehicle.

Space Defense

Regarding space defense, the Air Force wanted to insure there were a range of options to defend U.S. satellites and to protect against threats to the U.S. landmass from space. Emphasis went to improving the survivability of U.S. satellites, b1

) making evolutionary changes to Spacetrack radars in the Pacific and optical sensors worldwide, and developing a space based sensor.[103]

In April 1977, General Daniel James, Jr., then CINCAD, expressed concern[104] that while the U.S. had little or no space defense capability,[105] the Soviet military was vigorously pursuing one.[106] As an indication of their appreciation of the growing dependence on space systems

and space operations, the Soviets were actively testing and developing a non-nuclear antisatellite system.[107]

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The Miniature Homing Vehicle

The Miniature Homing Vehicle (MHV) was to be the primary program in the Space Defense System. Definition studies had been conducted during the last two years. Of the system design reviews, the F-15C was preferred for air launch with a modified short range attack missile (SRAM) and long range tracking and instrumentation radar. Other options considered were the Minute-man with warhead, the F-106, and the F-15A.[121]

b1

The LWIR sensor performance was also below specification. The net result of these developments was that the F-15C/SRAM would be adequate to negate those satellites posing the greatest hostile threat, but might not be effective against all low altitude JCS 2 and 3 targets.[122] The cost of an air-launch MHV would be $720 million plus $12 million for each missile.[123] Under an accelerated program, the estimated IOC was 1982 and FOC was 1984.[124]

Conventional Vehicle Status

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b1

High Energy Laser Status

b1

Instrumented Test Vehicle

b1

Space Transportation System

In the fulfillment of future U.S. space objectives DOD and NASA proposed using the national Space Transportation System (STS). The objective of the STS was to provide the U.S. with an economical means of delivering payloads of men, equipment, supplies, and other spacecraft to and from space. The STS consisted of an earth-to-orbit Space Shuttle, expendable upper stages, Spacelab, and

ground support equipment and facilities. SAMSO was designated DOD manager of the Space Shuttle Support Operation.[135]

Space Shuttle

b1

The Space Shuttle consisted of a reusable manned orbiter with three main engines, two reusable solid rocket boosters, and an expendable liquid propellant tank referred to as the external tank. The shuttle was being designated to place payloads weighing up to 65,000 pounds and launched from the Space Center, Florida, into a 150nm due east orbit and those weighing 32,000 pounds and launched from Vandenberg AFB, California, specified 100nm near-polar orbit.[138]

The USAF was responsible for providing the genral purpose Shuttle equipment and facilities to perform the ground, launch, and landing activities for all Space Shuttle operations at Vandenberg. USAF would operate Vandenberg and plan for an IOC at Vandenberg in 1982. Command responsibilities were designated as follows:[139] Implementing Command: AFSC; Operating Command: To be Designated (until that time, AFSC would operate all DOD STS facilities to include, launching, serving, and controlling functions.); Support Command: Air Force Logistics Command (AFLC); Participating Commands: Air Training Command (ATC), USAF Security Service (USAFSS), Air Force Communication Service (AFCS), Air Force Office of Special Investigation (AFOSI), SAC, and ADCOM; Test and Evalaution Agency: Air Force Test and Evaluation Center (AFTEC). Command responsibilities were further broken out with the exception of ADCOM which read, "ADCOM will, within existing resources, perform the same tasks as assigned to SAC."[140] These ADCOM/SAC tasks were as follows:[141]

a. Designate a command focal point for DOD STS activities.

b. Consider integrating command personnel into the AFSC STS program office in order to provide an operational perspective while developing in-depth knowledge and experience in the DOD STS program.

c. Interface with and provide documentation and staff assistance to AFSC in the development of DOD STS Operations Concepts and operations plans, to include the areas of flight planning, scheduling, mission control and ground support operations.

d. Make recommendations to AFSC and AFTEC on test requirements and comment on test results for operational suitability.

e. Make recommendations to AFSC regarding current and future program requirements and capabilities in areas that include communications, Automated Data Processing (ADP) systems, and system security.

f. Interface with and provide staff assistance to AFSC in the preparation of the DOD STS Training Plan.

As for the status of the program, the design, development, test and evaluation (DDT&E) phase of the STS program was well underway. A series of Space Shuttle Orbiter approach and landing tests had been completed at Edwards AFB, CA. The next major Space Shuttle flight test activity con-sisted of a series of Orbital Flight Tests (OFT) which were scheduled for 1979 and 1980.[142]

<u>ADCOM General Operational Requirement for an Advanced Operational Space Launch/Space Flight Capability</u>

b1

addressed the mission area of military space operations, specifically, launch and space flight, payload development, and the on-orbit control of military satellites.[143] The b1 developed a space defense military policy that would move space operations out of the 1980s and into the 1990s utilizing the National Space Shuttle program as the development vehicle. In the GOR, the National policy of the United States was stated as being committed to the peaceful use of space, but reserving the right of self-defense in space and conducting those activities in space which were necessary to national defense. The GOR stated that ADCOM had over the years been associated with space surveillance, space weapons, space launch, and related reporting, command, control, and communications responsibilities; and that those tasks performed as research and development over the past 20 years should be placed under ADCOM due to the increased operational nature of space launches and the increased reliance of space systems. In addition, space launch or launch of replacement satellites should be placed with operational commanders who were dependent on satellites and/or space flight for critical war fighting support. In this regard, space launch/space

flight systems should be designed for use by military personnel rather than for research and development and/or contract personnel. As for future space operations, especially antisatellites, the GOR listed three candidates. The first was called the Silo Based Opltion and would use satellites designed for other missions such as DSP, DMSP, and IONDS as replacements for the lost satellite. These satellites could be modified to provide emergency backup for the more critical satellites and could be launched from silos. The second option was the Militarized Space Transportation System, and there modifications would be made to provide a more flexible military space launch capability. ADCOM recommended more, but smaller, shuttle vehicles; proliferation of launch pads; and separate planning, operations, and communications centers. The third option was the Single-Stage-to-Orbit Vehicle. The vehicles in the third option would be like aerospace planes having alert sites and the survivability, responsiveness, and flexibility found in today's aircraft.[144]

NOTES

CHAPTER IV - BALLISTIC MISSILE SURVEILLANCE AND WARNING

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54. Msg (U), 031905Z Nov 78, 13MWS to ADCOM (Doc 34).

55. Msg (U), 022000Z Nov 78, ADCOM to 12MWG and 13MWS (Doc 35).

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67. Msg (S-Decl-86), 231530Z Oct 78, USAF to ADCOM (Doc 40).

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GLOSSARY OF ABBREVIATIONS

AABL	Advanced Atmospheric Burst Locator
AAC	Alaskan Air Command
AAP	Army Ammunition Plant
AB	Air Base
ABNCP	Airborne Command Post
ACMI	Air Combat Maneuvering Instrumentation
ACOC	ADCOM Combat Operations Center
ACT	Air Combat Tactics
ADA	Air Defense Artillery
ADC	Air Defense Command (redesignated Aerospace Defense Command on 15 January 1968)
ADCOM	Aerospace Defense Command
ADIC	ADCOM Intelligence Center
ADP	Automated Data Processing
ADSP	Advanced Space Defense Program
ADWC	Air Defense Weapons Center
AERODS	Aerospace Defense Squadron
AEW&C	Airborne Early Warning and Control
AFAL	Air Force Avionics Laboratory
AFB	Air Force Base
AFCS	Air Force Communications Service
AFETR	Air Force Eastern Test Range
AFLC	Air Force Logistics Command
AFOSI	Air Force Office of Special Investigations
AFR	Air Force Regulation
AFRES	Headquarters, Air Force Reserve
AFS	Air Force Station
AFSC	Air Force Systems Command
AFTEC	Air Force Test and Evaluation Center
AFWTR	Air Force Western Test Range
AG	Air-to-ground
AGE	Aerospace ground equipment
AHRS	Altitude Heading Reference System
AIM	Air intercept missile
AIN	Army Installation
AK	Alaska
ALC	Air Logistics Center
ALCOP	Alternate Command Post
ALCOR	ARPA-Lincoln C-band Observable Radar
ALTAIR	ARPA Long-range Tracking and Instrumentation Radar
ANG	Air National Guard
ANGB	Air National Guard Base
ANR	Alaskan NORAD Region
ANMCC	Alternate National Military Command Center

APDM	Amended Program Decision Memorandum
AROH	Automatic reporting of height
ARPA	Advanced Research Projects Agency
ARTCC	Air Route Traffic Control Center
AS	Air Station
ASDC	Alternate Space Defense Center
ASIP	Aircraft Structural Integrity Program
ATC	Air Training Command
ATH	Above the Horizon
AU	Air University
AWACS	Airborne Warning and Control System
AWACW	Airborne Warning and Control Wing
AW(F)	All Weather (Fighter)
AZ	Arizona
BLM	Bureau of Land Management
BLOS	Beyond Line-of-Sight
BMEWS	Ballistic Missile Early Warning System
BSSC	Battle Staff Support Center
C3	Command, control, and communications
CA	California
CADC	Central air data computer
CADIN	Continental Air Defense Integration North (NORAD)
CDI	Common Defense Installation
CF	Canadian Forces
CFB	Canadian Forces Base
CGS	CONUS Ground Station
CINC	Commander in Chief
CINCAD	Commander in Chief, Aerospace Defense Command
CINCLANT	Commander in Chief, Atlantic
CINCNORAD	Commander in Chief, North American Air Defense Command
CINCONAD	Commander in Chief, Continental Air Defense Command
CINCPAC	Commander in Chief, Pacific
CINCSAC	Commander in Chief, Strategic Air Command
CJCS	The Chairman, Joint Chiefs of Staff
Co	Company
CO	Colorado
COC	Combat Operations Center
COMAAC	Commander, Alaskan Air Command
COMICE-DEFOR	Commander, Iceland Defense Force
CONAD	Continental Air Defense Command
CONUS	Continental United States

CSAF	Chief of Staff, United States Air Force
CSAM	Chief of Staff Army Memorandum
CV	Conventional vehicle
CY	calendar year
DACT	Dissimilar Air Combat Tactics
DAD	Designated Alert Detachment
DB	Dispersal base
D. C.	District of Columbia
DCS	Deputy Chief of Staff
DDC	Data Distribution Center
DDT&E	Design, development, test, and evaluation
Def	Defense
DEFCON	Defense condition
Det	Detachment
DEW	Distant Early Warning
DIA	Defense Intelligence Agency
Div	Division
DMSP	Defense Meteorological Satellite Program
DND	Department of National Defence, Canada
DOD	Department of Defense
DSARC	Defense System Acquisition Review Council
DSCS	Defense Satellite Communication System
DSEG	Defense System Evaluation Group
DSES	Defense System Evaluation Squadron
DSP	Defense Support Program
DT	Detection Radar
DVP	Design Verification Period
D&W	Detection and Warning System
EADF	Eastern Air Defense Force
EBMEWS	Enhanced Ballistic Missile Early Warning System
ECCM	Electronic Counter-countermeasures
ECM	Electronic Countermeasures
EDEW	Enhanced Distant Early Warning
EMI	Electromagnetic Interference
EOC	Equivalent Operational Capability
EPA	Environmental pollution abatement
EPARCS	Enhanced Perimeter Acquisition Radar Attack Characterization System
ESD	Electronic Systems Division
ESV	Earth Satellite Vehicle
ETS	Engineering Test Series
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FELEC	Federal Electric Services Incorporated

FIS	Fighter Interceptor Squadron
FL	Florida
FMB	Financial Management Board
FMS	Foreign Military Sales
FOC	Final Operational Capability or Full Operational Capability
FOED	Follow-on Event Data
FOI	Follow-on intercepter
FORSCOM	Army Forces Command
FOUO	For Official Use Only
FSI	Federal Services Incorporation
FY	fiscal year
GBL	Ground Based Laser
GCI	Ground-Controlled Intercept
GCN	Ground Communications Network
GDSUC	Ground Data System Updating Change
GEODSS	Ground-based Electro-Optical Deep Space Surveillance
GIUK	Greenland-Iceland-United Kingdom
GOR	General Operational Requirement
GPS	Global Positioning System
HAC	Hughes Aircraft Company
HEL	High Energy Laser
HF	high frequency
HO	Handoff or History Office
HQ	Headquarters
HQ STC	Headquarters, RAF Strike Command
HSD	High Speed Data
IAP	International Airport
IBM	International Business Machines, Corporation
ICBM	Intercontinental Ballistic Missile
IG	Inspector General
IOC	Initial Operational Capability or Interim Operational Capability
IONDS	Integrated Operational NUDET Detection System
IOT&E	Initial operational test and evaluation
IRBM	Intermediate Range Ballistic Missile
IRON	Inter-Range Operations Number
ISA	International Security Affairs
ITT	International Telephone and Telegraph
ITV	Instrumented Test Vehicle
JCS	Joint Chiefs of Staff
JCUSMMAT	Chief, Joint U.S. Military Mission for Aid to Turkey
JETS	Joint Enroute Terminal System

JNA	Joseph Nunn Associates
JRPG	Joint Radar Planning Group
JSAP	Joint Acquisition Panel
JSCP	Joint Strategic Capabilities Plan
JSS	Joint Surveillance System
km	kilometer
KR	ADCOM DCS/Communications, Electronics, and Computer Resources
KS	Kansas
LA	Louisiana
LOA	Letter of Offer and Acceptance
LRR	Long range radar
Lt	Lieutenant
LV	Launch Vehicle
LWIR	Long Wavelength Infrared
MA	Massachusetts
MAC	Military Airlift Command
MAJCOM	Major Command
MDM	Mission Data Messages
MDSC	Modular Digital Scan Converter
ME	Maine
MEISR	Minimum Essential Improvement for System Reliability
MEW	Missile Early Warning
MFS	MINATOR-Flexlink-Snuggler
MGT	Mobile Ground Terminal
MHV	Miniature Homing Vehicle
MI	Michigan
Milcon	Military construction
MIP	Material Improvement Program
MIPOP	Missile Impact Predictor Operational Program
MIT	Massachusetts Institute of Technology
MMC	Martin Marietta Corporation
MMST	multimode storage tube
MOB	Main Operating Base
MOT	Ministry of Transport (Canada)
MOU	Memorandum of Understanding
MRBM	Medium-range Ballistic Missile
MSFC	Marshall Space Flight Center
MSP	Mosaic Sensor Program
MST	mountain standard time
MT	Montana
MTBF	mean time between failures
MWC	Missile Warning Center

MWDS	Missile Warning and Display System
MWS	Missile Warning Squadron
NASA	National Aeronautics and Space Administration
NASS	North American Surveillance Systems
NATO	North Atlantic Treaty Organization
NAVSPASUR	Navy Space Surveillance
NB	New Brunswick
NC	North Carolina
NCA	National Command Authority
NCMC	NORAD Cheyenne Mountain Complex
NCOC	NORAD Combat Operations Center
ND	North Dakota
NDHQ	National Defence Headquarters
NEACP	National Emergency Airborne Command Post
NFA	new fighter aircraft (Canada)
NJ	New Jersey
NM	New Mexico
nm	nautical mile
NMCC	National Military Command Center
NOA	not operationally assigned
NOE	NORAD Operational Evaluation
NORAD	North American Air Defense Command
NUDET	nuclear detonation report
NV	Nevada
NY	New York
OFT	Orbital Flight Test
OGS	Overseas Ground Station
OK	Oklahoma
OL	operating location
OLAA	Operating Location AA
OLAD	Operating Location AD
OLAJ	Operating Location AJ
OLAM	Operating Location AM
O&M	Operations and Maintenance
OOB	Operations Operating Budget
OPlan	Operation Plan
OR	Oregon
ORI	operational readiness inspection
OSD	Office of the Secretary of Defense
OSM	Operational Support Module
OTH-B	Over-the-Horizon Backscatter
OWS	Orbital Workshop
PA	Pennsylvania
PACBAR	Pacific Radar Barrier
PAD	Programmed Action Directive
PARCS	Perimeter Acquisition Radar Attack Characterization System

PAWS	Phased-Array Warning System
PBD	Program Budget Decision
PCB	printed circuit board
PCD	Program Change Decision
PCDI	Pirinclik (Turkey) Common Defense Installation
PDM	Program Document Memorandum or Program Decision Memorandum
PJBD	Permanent Joint Board
PMD	program management directive
PNUT	Possible Nuclear Underground Test
POL	petroleum, oil, and lubricants
POM	Program Objective Memorandum
PPG	Planning and Programming Guidance
PPI	Plan Position Indicator
PRAM	Productivity, Reliability, Availability, and Maintainability
PRC	People's Republic of China
RADES	Radar Evaluation Squadron
RCA	Radio Corporation of America
R&D	Research and Development
RDT&E	research, development, test and evaluation
ROC	Required Operational Capability.
ROCC	Region Operations Control Center
ROD	required operational date
RORSAT	Radar Ocean Reconnaissance Satellite
RPIE	Real Property Installed Equipment
RRG	Requirements Review Group
RSSF	ROCC Software Support Facility
SAC	Strategic Air Command
SAGE	Semi-automatic Ground Environment
SALT	Strategic Arms Limitation Treaty
SAMSO	Space and Missile Systems Organization
SAO	Smithsonian Astrophysical Observatory
SATRAN	Satellite Reconnaissance Advanced Notice
SAWS	Satellite Attack Warning System
SAWV	Satellite Attack Warning and Verification
SAWVS	Satellite Attack Warning and Verification System
SC	South Carolina
SCRG	Stable Coordinate Reference Group
SDC	Space Defense Center or System Development Corporation
SecDef	Secretary of Defense
SIOP	Single Integrated Operational Plan
SED	Sensor Evolution Development

SLBM	Sea Launched Ballistic Missile
SLIM	Simplified Logistics and Improved Maintenance
SOC	System Operational Concept
SOI	Space Object Identification
SPADATS	Space Detection and Tracking System
SPADCCS	Space Defense Command and Control System
SPADOC	Space Defense Operations Center
SPO	System Program Office
SPS	Simplified Processing Station
Sq	Squadron
SRAM	Short Range Attack Missile
SRS	Satellite Readout Station
SSIP	Sensor Site Implementation Plan
STS	Space Transportation System
STSTE	Satellite Tracking Set Training Equipment
SurvS	Surveillance Squadron
TAC	Tactical Air Command
TACAN	tactical air navigation
TCTO	time compliance technical orders
TDDL	Time Division Data Link
TDY	temporary duty
TFS	Tactical Fighter Squadron
TFW	Tactical Fighter Wing
TIP	Tracking and Impact Prediction
TLM	Tactical Load Module
TNCC	Tyndall NORAD Control Center
TOR	Tactical Operations Room
TPDM	Tenative Program Document Memorandum
TR	Tracking Radar
TRW	Thompson-Ramo-Wooldridge, Incorporated
TSP	Target Signatures Program
TUSLOG	The U.S. Logistics Group (Turkey)
TV	television
TX	Texas
UCP	Unified Command Plan
UE	unit equipment
UHF	ultra high frequency
UIT	User Integration Test
UK	United Kingdom
U.S.	United States
USA	United States Army
USAF	United States Air Force
USAFE	United States Air Forces in Europe
USAFSS	USAF Security Service
USCINCEUR	United States Commander in Chief, Europe
USCINCRED	United States Commander in Chief, Readiness Command

USEUCOM	United States European Command
USMC	United States Marine Corps
USN	United States Navy
USPACOM	United States Pacific Command
USREDCOM	United States Readiness Command
USSR	Union of Soviet Socialist Republics
VA	Virginia
VHF	very high frequency
VT	Vermont
WA	Washington
WI	Wisconsin
WIC	Warning Information Correlation
WRS	weapons readiness state
WWADE	Worldwide Air Defense Enhancement
WWMCCS	Worldwide Military Command and Control System